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SAPC 23204
COPY 2 OF 3

3 January 1958

25X1

To: [redacted]

From: [redacted]

Subject: Report of Current Activities

ABSTRACT

1. Three Configurations (B #13, A-2 #12, A-2 #13) are ready for shipment to Del Rio.

2. A second Shutter HS-732 ran 170,000 cycles without malfunction in a durability test.

3. Simple additions to the radio noise filters provided adequate suppression in Configuration C.

4. Reliability of Configuration B has been established in 15 successive missions with satisfactory electrical and mechanical operation.

5. The quality of Configuration B photo results has consistently been 35 l/mm in the later flights. Further work may improve this in January.

LIST OF ENCLOSURES

1. Configuration B Rework

2. Durability Test HS-732

3. Progress Report on the 73-B Vibration Problem

4. Radio Interference Tests on HR-73C Configuration

5. Interim Report, Cold Temperature Tests, Configuration 73-C Optical System

6. Flight Test Schedule

7. Manning Chart, Field Service Department

8. Preliminary Engineering Report on Resolving Power of some aerial film

9. Location of Configurations

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1. EQUIPMENT

1.1 Configuration B Rework. (See Enclosure (1).)

The detailed program is continuing for the rework of the B Configuration to:

Maximize Reliability;
Maximize Photo Quality; and
Incorporate Additional Necessary Features.

The program is aimed toward shipping proved B cameras overseas by 15 March 1958.

1.2 Shutter HS-732 (See Enclosure (2).)

A second shutter durability test was conducted using Shutter #39. The shutter operated 170,000 cycles without malfunction. The periodic inspection, adjustment and lubrication which is done in the field every 5,000 cycles was, for the purpose of this test, done every 10,000 cycles. The shutter will operate normally at -20 degrees F. but will not operate at -65 degrees F. Shutter speed remained constant (approximately 1/240 second) throughout test. At the end of the test the worm gear was worn and needed replacing. The ring gear was worn and bearing groove wear permitted excess backlash. Slight shutter blade bounce was noted. The latches, blades, worm, bearings, etc., were in satisfactory condition and adjustment.

1.3 Vibration Studies of B Configuration (See Enclosure (3).)

Accelerometer tests with the configuration mounted in the article on the ground indicated the vibration characteristics were identical to those measured with the configuration mounted in the test stand in the lab. Instrumentation is being prepared to make accelerometer tests in flight. Lab tests are continuing to determine resonant frequencies of optical components and forcing frequencies of drives.

1.4 Radio Noise (See Enclosure (4).)

Radio noise filters installed in C #2 were checked for effectiveness in flight. The pilot reported radio noise was undetectable. The radio noise filters are being manufactured for installation on all C configurations. In flight tests with configuration B, radio noise has also been reported undetectable.

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1.5 Configuration C

The second set of optics was received and trial assembly made in C #4. Some slight interferences were encountered and the camera structure and optics reworked for proper fit. The lens barrel was returned to PE for further work on some of the elements.

Camera C #2 with Lens CL #1 is being used for tests of temperature and vibration.

Lab tests were conducted on the effect of temperature on focus. The first series of tests is reported in Enclosure (5). As a result of these tests, the lens barrel heater requirements have been increased and additional insulation has been provided. A second test series is currently in progress. The new lens barrel heater and insulation will maintain the surface temperature of the barrel at 75 degrees F, plus or minus 2 degrees F, with an ambient temperature of 35 degrees F as encountered in the equipment bay. With proper selection of thermostats it is expected control can be maintained to plus or minus 1 degree F.

Additional work has been done to further reduce vibrations due to gyros, programmer, film drive motor, and shutter. Another vibration analysis will be made on the camera after the temperature tests are completed.

In recent C Test Flights, a series of three film drive malfunctions occurred. These were intensively studied and in-plant tests conducted to identify the source and make corrections. Two problems were isolated:

(1) In one flight, one supply spool was apparently improperly spooled. The data has been referred to Ed Green.

(2) In the other two flights the operation of the film drive shuffle and the film tension sensor under rough air conditions became marginal. The spring and counterbalance on the shuffle and the tension regulator programming are being revised to provide a higher margin for unusual operating conditions.

Caging of Configuration C has been under study for several months. In one flight vibration in the photo results were observed due to caging transients. Post-flight maintenance and adjustment of the caging mechanism eliminated the transients in the next flight. It was felt however that with better optics the caging transient might be significant and a simple method of servo caging is being studied. Mechanical caging would be used only when the camera is in standby or off.

One of the objectives of the recent flight tests of C #2 was to estimate the pointing accuracy of the spotting mode. Accuracy was sufficient to obtain air strips and small towns within the four-frame rectangular array with stereo superposition of the second four frames.

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HYCON MODEL 73-C CAMERA SYSTEM

RADIO INTERFERENCE SUPPRESSION

WORK PLAN

25 October 1957

1.0 INTRODUCTION

1.1 Subject. The subject with which this work plan is concerned is the radio noise interference which is created by the 73-C Configuration.

1.2 Purpose. It is intended that this work plan be a systematic and logical approach to the problem of radio interference in the 73-C. It is not meant to be a rigid plan, but one which presents a framework for the systematic solution of each problem.

1.3 Scope. Basically, the intention is to detail a procedure of testing, correction, performance testing, and evaluation. An appendix is attached which outlines briefly the general problem of radio interference.

2.0 DESCRIPTION OF THE PROBLEM

2.1 Radio Interference. Specifically, the 73-C Configuration generates noise which interferes with the aircrafts radio and ADF equipment.

2.2 Mode of Propogation. Two modes exist: conduction and radiation. It is expected that both modes will be encountered.

2.3 Frequency Range. The frequency range of interference with which we are concerned extends from 150 KC to 400 MC.

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2.4 Permissible Levels. The level to which the radio interference is to be reduced shall be defined as the level which permits the aircraft's radio equipment to perform satisfactorily. This shall be determined by Hycon engineers in cooperation with the aircraft personnel concerned.

3.0 PROCEDURES.

3.1 Testing.

3.1.1 All units of the 73-C Configuration which are suspected of being interference sources are to be tested by either the radio noise facilities of Cornel-Dubilier (or similar facilities) or by our own RF (G.F.E.) receiver.

3.1.2 It shall be the function of the above test to determine the sources of radio interference, the interference level associated with each source, and to find filter devices and/or develop techniques which will reduce the level of interference.

3.2 Correction.

3.2.1 The results of the testing described in 3.1 will indicate the correct means of reducing the interference.

3.2.2 Units which are prime offenders will be modified first and tested as outlined in 3.3.

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3.2.3 It is anticipated that in the majority cases, the radio interference will be reduced adequately by the use of:

1) Filters.
2) Arc suppression devices.
3) Shielding.
4) Improved Bonding.

3.2.4 All corrective work shall be accomplished at Hycon Plant #9 under the supervision of the engineers responsible for the particular units.

3.3 Performance Testing

3.3.1 Each modified unit will be taken to the Test Site and installed in the 73-C Configuration.

3.3.2 The Configuration will be installed in the aircraft and operated in conjunction with the radio equipment.

3.3.3 A qualitative comparison of the interference levels and an evaluation of the improvement of the levels by the modification of each unit will be made at this time.

3.3.4 Further testing and improvement will depend upon the performance of the modified units as determined by a flight test.

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Progress Report No. 1

RADIO INTERFERENCE SUPPRESSION

WORK PLAN

24 October 1957

1. TESTS PERFORMED.

1.1 Units Tested As of this date, the following units have been tested by the radio noise facilities at Cornel-Dubilier Electric Corp., Venice, California.

1.	Gyro Sensor Assembly	Part No. 733895
2.	Film Take-Up Motor	Part No. 734360
3.	Aperture Motor	Part No. 733273
4.	Tension Regulator Motor	Part No. 734181
5.	Film Drive Motor	Part No. 733646
6.	Oblique Drive Motor	Part No. 733676
7.	Main Junction Box	Part No. 734120
8.	Film Drive Servo	Part No. 733640
9.	Oblique Drive Servo	Part No. 733670
10.	Stabilizer Servo	Part No. 733870
11.	Programmer	Part No. 733600
12.	Stabilizer Power Supply	Part No. 733885

Items 7, 8, 9, and 10 above comprise the Electrical Rock.

1.2 Conditions of Testing The radio interference testing facilities at Cornell-Dubilier Electric Corp., are designed and equipped to conform with the environmental requirements of Mil-I-6181B. In brief, this means the tests were performed in a screened room with no detectable interference present; the equipment being tested was mounted on a ground plane of specified minimum dimensions and properly bonded to the screen room; the equipment was bonded properly to the ground plane; line stabilization networks were utilized on the power lines; and AN-type radio interference measuring sets were used for quanitative results.

2.0 TEST RESULTS.

2.1 The units which were determined to be prime sources of radio interference were:

1. Film Take-Up Motor
2. Aperture Motor

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2.1 (cont'd)

3. Tension Regulator Motor
4. Film Drive Motor
5. Oblique Drive Motor
6. Programmer
7. Gyro Sensor Assembly

The order of the above list is not intended to indicate the magnitude of the radio interference emitted by each unit.

2.2 Recommendations. With the exception of the Gyro Sensor Assembly, which did not receive further testing, filter devices were tested and techniques recommended by Cornell-Dubilier for all other units listed above.

2.3 Levels After Filtering. Although Mil-I-6181B specifications are intended to be used only as a guide, tests performed by Cornell-Dubilier indicate that all the motors can easily be modified to be well below the specified maximun levels of Mil-I-6181B. Tests on the Programmer (after filtering) indicate a substantially reduced level which should be adequate.

3.0 MODIFICATIONS

3.1 Motors The motors tested (i.e., the Film Drive, Film Take-Up, Aperture, Tension regulator). Have been modified as follows:

a. A filter, of the type recommended by Cornell-Dubilier, has been installed.
b. The units have been reworked to obtain better shielding. This has mainly been accomplished by use of shielded wire.
c. Great care has been taken to insure good bonding between surfaces to improve the electrical ground. Insulating layers, such as anodize, have been removed at the points of contact and the surface cleaned.

The direct purpose of the above modifications is to contain the radio interference within each unit and thereby prevent conduction and /or radiation to occur.

3.2 Programmer. A shielded box has been constructed upon which has been mounted twenty five filters. This filter assembly has been taken to the Test Site, mounted adjacent to the Programmer, and the filters inserted into the appropriate leads. The filters used were recommended by Cornell-Dubilier.

3.3 Gyro Sensor Assembly. The prime sources of radio interference in unit are the heater circuits of the gyros. A double RC network of our own design has been installed across the relay contacts in each circuit of the unit in the 73-C Configuration at the Test Site.

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4.0 PERFORMANCE TEST.

4.1 Testing. The above modified parts were removed to the Test Site and installed in the 73-C Configuration there. Test procedures were carried out as outlined in the Work Plan, Section 3.3.

4.2 Test Result. After the configuration was installed the article was towed to a remote section of the flight line. The unit was operated in different Modes for half an hour while Mr. Joe Falcon, aircraft radioman listened on various receiver channels for radio noise. His opinion was that the noise had been reduced to an amount that was barely noticiable and would present no receiving problem.

4.3 Flight Test The 31 October 1957, Test Flight, of the 73-C will be used for a pilot's evaluation.

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2.4 Flight Test Schedule (See Enclosure (6).)

The proposed flight test schedule for January through April 1958 requires a high frequency of test flights in latter part of January and in February. The number of articles available and weather may be limiting factors. Two flights will be made with each B Configuration. After results have been analyzed and determined to be satisfactory, the configuration will be returned to M & O for preparation for deployment.

3. PERSONNEL (See Enclosure (7).)

The rotation of field personnel is proceeding in accordance with the schedule enclosed. This schedule differs from the one previously submitted in that it indicates a change in the rotation of [redacted]. In addition we are 25X1
proceeding to assign [redacted]s to maintain hand controls and drift sight at 25X1
the [redacted] Instruction of personnel rotating is proceeding. We have sent all our 25X1
processing personnel to [redacted] facility for a week's training. We also sent 25X1
two of our field men to Rod Scott's for refresher instruction in the maintenance of the Mark II tracker prior to our running the Red Dot Tracker series.

[redacted] reported to C Detachment on Tdy for the purpose of re-collimating all of C's A-2 configurations. 25X1

The two FOG instructor-type trainees reported on 9 December and their instruction is proceeding.

[redacted] reported to Del Rio on 9 December as our second tech rep in accordance with the terms of our FOG field service contract. 25X1

4. STAGING

A number of commentary reports on staging operations have been prepared by our field service engineers from all detachments. [redacted] is analyzing 25X1
this information and preparing a final consolidated report and recommendations. Other than providing adequate shelter, and better portable 70 mm processing equipment at the staging area, there are only minor changes in or additions to ground equipment required. Recommendations are mainly concerned with procedures and pre-staging requirements.

5. OTHER COMMENTS

5.1 Film Resolving Power (See Enclosure (8).)

A film resolving power test was made by our optical lab. It indicates the resolving power of thin base film, 0-3, is considerably better than that of Aero xx. The Red Dot film, 0-8, had a resolving power beyond the limit of our reticle, 114 lines/mm.

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5.2 Configuration A-1 Overhaul

A preliminary check indicates the cartographic characteristics of the HC-730 cameras have been unaffected in their tour of duty. Further checks are being made. A review of HC-730 spares was made and a recommended re-distribution submitted.

5.3 Shutter HS-731 Leaf Assemblies

200 spare leaf assemblies are being obtained out of shutters at Mobile by Bob Welch. None have been received but 25 are expected this week. Ed Green obtained a quotation of $112.92 each with five months delivery from Fairchild for 100 spare leaf assemblies. They can be ordered if the spares from Mobile are not satisfactory. Detail drawings of leaf assembly parts were sent to us by Sid Brewer in order to permit us to salvage some leaf assemblies by manufacturing replacement links.

5.4 Rolit

Installation of the Rolit at EAFB is ready to proceed pending approval by Headquarters.

5.5 Spares Survey

Completion of the C spares deliveries in January and February will provide satisfactory lead time for the coming photo season. Hycon is planning to take a physical inventory of the photo areas at all locations on 31 January 1958. This will reveal any discrepancies between the records and the physical assets in time to take action prior to the start of the photo season.

5.6 B Film Boxes

Ten new steel B film boxes were shipped to us by Ed Green on 24 December. We have manufactured ten sets of B spool shipping spiders to a new, more rugged design. When the steel boxes arrive, we will make some trial packaging arrangements.

5.7 Location of Configurations (See Enclosure (9).)

The latest information on the physical location of configurations is tabulated in Enclosure 9.

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CONFIGURATION B, REWORK

MAXIMIZE RELIABILITY

1. Added stiffness to camera members to control film tracking. Design in final approved stage. Production began week of 1 December.

1.1 New Stiffener bar to cross panel to maintain roller parallelism under overload conditions.

1.2 New cassette shafts to limit load deflections to 0.005.

1.3 New clamp type cassette shaft supports to provide positive clamping of shafts during camera operation. The design also offers adjustable lateral positioning and securing of the spools to aid in film tracking.

1.4 New 6-inch spool cores to add stiffness to flanges.

1.5 New sheet metal stiffener beams added to structure side panels. Beams are secured to camera main torsion bar and extend to two corner points of structure that support the film spool shafts. Design in layout stage; production to begin week of 8 December.

2. Added strength to driving members. Design in final approval stage; production began week of 1 December.

2.1 Film Drive

2.1.1 Adaption of more ball bearings throughout to replace bronze type to allow smoother operation with decreased demands on motor.

2.1.2 New stronger drive shafts.

2.1.3 New pressure and idler rollers.

2.1.4 New supporting brackets for cantilevered bearing shafts.

2.1.5 Internal changes to gear box to use brazed gear and shaft assemblies to replace pins and screws.

2.2 Oblique Drive

2.2.1 Improved security of pulley on gear box output shaft.

2.2.2 Internal changes to gear box to use braized gear and shaft assemblies to replace pins and screws.

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2.3 Take-up Drives

2.3.1 All Motordyne type motors have been replaced with Western Gear type motors. Experience indicates the Western type is more reliable, quieter operating, and better matched to the load demands, especially the 6,000 ft. load.

3. General Design Improvement

3.1 Adjustable oblique brake device now in production as an aid in postflight maintenance to insure positive positioning of lens assembly.

3.2 Cassette centering device improvement in design phase for correct positioning of cassette for film spool alignment.

3.3 Investigation is in progress to provide stronger film tension limit stops and a system of less critical adjustment. Production expected to start week of 8 December.

4. General Studies

Environmental tests have been conducted on the shutter operating in a vacuum under both hot and cold conditions. No adverse affects upon material or operation were noted.

Examination of all parts returned to the factory show corrosive action in some external parts on unit from C Detachment only, but no evidence of corrosion was found as a deterrent to camera operational reliability. C Detachment unit shop ran four complete missions during tests before disassembly for major maintenance and current rework.

Complete system environmental test in cold chamber will be conducted upon completion of rework program.

A series of tests have been made to study the feasibility of eliminating the tension sensor and servo system as an aid to reliability. The tests indicated that under normal conditions the film would transport properly without the aid of the sensor system. However, when the take-up spool diameter reached a point approximately halfway through a film roll, any increase in drag due to a worn bearing, voltage drop, or spool flange pressure, the motor could stall and stop taking up the metered film. It was decided that the factor of safety and reliability by having the demand power response capability of the sensor system on the camera was worthwhile and steps then taken to improve the design where possible. (See 3.3)

Life cycle tests are complete on the film drive, improved oblique drive motor, take-up motors, and the tension sensor systems. Approximately 80,000 feet of

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film or over 13 (6,000 ft.) missions have been successful with no malfunctions or replacements of these components. Sixty percent of the missions were actual test flights.

Evaluation tests are complete on the take-up motor demand versus capability to reaffirm initial motor specifications. Results show Western Gear type motor adequate for application with good safety margin capability.

Analysis of test flight results show that vacuum failures will not occur due to the camera vacuum system providing the vacuum valve is periodically inspected and adjusted per the post maintenance procedures. A spring-loaded plunger design is being tested to minimize possibilities of improper adjustment which is critical at present. Aircraft instrumentation to record bay differential vacuum pressures will be performed on a near future test flight at EAFB. Report to follow.

MAXIMIZE PHOTO QUALITY

1. Vibration (See Encl. 3)

1.1 Shutter

Design for shock mounting the shutter is complete and in production. The design calls for the addition of six soft spherical rubber buttons, set deep into the shutter castings that isolate the shutter assembly from the lens housing. Shutter castings must be machined to provide additional clearance for free movement within the lens housing. Light sealing is accomplished by addition of nylon velvet ribbon set into shutter at mating surfaces around "drawer" opening.

1.2 Motors

Design for shock mounting the film drive, take-up and oblique motors is complete and in production. All motors will be mounted on rubber grommets. Vibration and noise level has been greatly reduced.

1.3 Mirror and Platen

Design changes pending accelerometer studies.

1.4 In-flight aircraft three-axis motion rate recordings. (See Encl. 3)

2. Design improvement affecting photo quality. Production to begin week of 1 Dec.

2.1 New improved IMC direct drive system utilizing one-piece cycle shaft, silent chain drive, and simplified clutch-gear housing to eliminate all backlash in driving train.

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2.2 New cassette light seal to camera body. Sponge rubber removed from light seal channel frame on cassette and lip frame on camera increased in height to provide a non-contact light-tight baffle.

2.3 New adjustable focus posts to provide ready means to perform corrective focus changes if necessary and as an aid to factory collimation procedures. Posts will be locked and safety wired after factory collimation.

2.4 Improved data image by tests using a masking aperture in the housing and altering the black and white painted surfaces to obtain constant diffused light over the entire data card.

2.5 New oblique cyclic drive to minimize operational shock vibrations on the optical structure will be tested week of 1 December. Report to follow.

2.6 Mirrors currently being inspected for necessary recoating. ~~Investigation in progress to determine feasibility of quartz coating mirror surfaces for protection to prolong mirror reflective quality life.~~

INCORPORATE ADDITIONAL NECESSARY FEATURES

1. Remote Control

Complete pilot capability to select and operate the camera from the cockpit in all Patterns and modes of operation, both horizon to horizon full terrain coverage, and selected areas vertical, left and right concentrated targets.

1.1 Programmer Model HP8191. In production starting week of 24 November. Final design to production week of 1 December.

1.2 New two-speed film drive motor.

1.3 New camera wire harnesses.

1.4 Engineering investigation is near completion on necessary changes to add two additional selective positions to hand controls Marks I and II. Rework includes replacement of selector switch in Mark I and Mark II units with additional wires. Mark III unit to be reworked to add two additional wires. Minor electrical changes are necessary on the A/C Junction Box. A luminous decal nameplate will be provided to indicate additional switch positions. A luminous switch pointer knob will be provided as an added feature to the hand controls. A field service bulletin is being prepared delineating necessary changes to each type of equipment although it is recommended that rework be performed at the manufacturer's factory. Engineering has placed orders for all parts as switches are a long term procurement item. Service bulletin to be complete week of 8 December. <u>All</u> lights to be <u>green.</u>

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2. Improved B material shipping assembly.

Production in process for ten experimental ruggedized shipping flange assemblies. Evaluation continuing for simpler design.

3. Radio noise suppression (See Encl. (4).)

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von Stroh PREPARED BY	PASADENA **HYCON MFG. COMPANY** CALIFORNIA	PAGE 1 of 12
CHECKED BY [illegible]	**DURABILITY TEST HS-732** **Serial #39**	JOB
DATE 12/4/57		REPORT

PURPOSE: To conduct a durability test of Shutter HS-732, Serial #39.

TEST CONDITIONS:

1. Shutter was operated on the bench in Maintenance & Overhaul shop by Field Engineer, Gordon von Stroh.

2. In the initial part of the test, the shutter was operated at runaway, which is obtained by applying a continuous trip voltage to the shutter; the interval between shutter firings is 1.1 to 1.4 secs, depending upon the speed of the rewind motor. When the rewind motor has recocked, the drive springs and latches are in place, [redacted] the shutter is immediately fired. This is a more severe test than operating the shutter by intervalometer, or in the camera with the normal 4-1/2 sec interval between shutter firings. The shutter was operated at runaway at the start in order to shorten the total elapsed time of the test. During the latter part of the test it was operated by intervalometer at 28 cycles per minute.

3. A 10,000 cycle interval between inspections was selected as a more rigid test of the shutter. Field instructions require 5,000 cycle inspection, lubrication and adjustment. The shutter was run continuously for at least 4,000 cycles before stopping for any reason other than inspections or end of work period in order to simulate the required minimum duty period as closely as possible.

4. A check of the shutter speed, with test set (light source, oscilloscope, photocell) was made periodically during the test. The measured speed must be multiplied by 1.2 to obtain actual effective shutter speed. Speeds quoted in this report are the actual effective shutter speeds.

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5. Prior to the durability test, the shutter was operated 2,500 cycles during routine quality control checking, inspection and adjustment.

6. After 140,000 cycles of testing, the shutter was subjected to low temperature, high altitude operating conditions for 20,000 cycles.

7. At the start of the test:

   Runaway Rate: 52 cycles per minute

   Shutter Speed: 1/220 sec

   Worm Gear in #2 position

TEST DATA:

Nov. 1, 1957 - Friday

At 1:05 pm the unit was connected to electrical test equipment containing the necessary switches and cables. The trip switch of the tester was placed in the "on" position. This produces a runaway condition in the shutter. Power was applied.

Running time: 1:05 pm to 3:50 pm

8,360 cycles - from 2:05 pm to 3:50 pm. Runaway rate was 50 cycles per minute. No malfunctions - Test off for weekend. Total Cycles: 8,360

Nov. 4, 1957 - Monday

Test continued at 8:15 am to 9:10 am

Operated at runaway at 50 cycles per minute.

1,640 cycles, to complete 10,000 cycle run. Stopped to perform 10,000 cycle maintenance check. At this time the unit was again timed, using the photocell and oscilloscope camera. Time, 1/240 sec.

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A readjustment of the worm gear was made and items on the standard maintenance and inspection list for 10,000 cycles were checked.

Worm gear remained in #2 position. Total Cycles: 10,000

Nov. 4, 1957 - Monday

The unit was placed back on test at ;;:30 am

Running time: 11:30 am to 2:35 pm

Operated at runaway rate of 54 cycles per minute.

10,000 cycles Total Cycles: 20,000

Nov. 4, 1957 - Monday

The unit was subjected to a timing test, using the photocell and equipment noted previously. Time, 1/240 sec. The unit was then given a 10,000 cycle periodic maintenance check. The unit was placed back on test.

Running time: 3:05 pm to 5:05 pm

Operated at runaway rate of 54 cycles per minute.

6,380 cycles. Test stopped overnight. Total Cycles: 26,380

Nov. 5, 1957 - Tuesday

Test continued at 8:10 am

Running time: 8:10 am to 9:10 am

Operated at runaway rate of 54 cycles per minute.

3,070 cycles to complete 10,000 cycle run. Unit timed and subjected to a 10,000 cycle maintenance check. Time, 1/238 sec.

Total Cycles: 30,000

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Nov. 5, 1957 - Tuesday

Test continued at 10:25 am

Running time: 10:25 am to 1:35 pm

Operated at runaway rate of 54 cycles per minute.

10,000 cycles; speed and maintenance check. Time, 1/240 sec.

Total Cycles: 40,000

Nov. 5, 1957 - Tuesday

Test continued at 2:10 pm

Running time: 2:10 pm to 5:00 pm

Operated at runaway rate of 54 cycles per minute.

9,400 cycles. Test stopped for the night. Total Cycles: 49,400

Nov. 6, 1957 - Wednesday

Test continued at 8:05 am

Running time: 8:05 am to 8:20 am

Operated at runaway rate of 54 cycles per minute.

600 cycles to 10,000 check. Time, 1/240 sec.

The ring gear carrier bearings required slight adjustment to take up wear. Total Cycles: 50,000

Nov. 6, 1957 - Wednesday

At 50,000 cycles, the rewind motor was due for overhaul. The test was deliberately continued without overhaul of the motor to determine the safety factor in specific overhaul period.

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Test continued at 1:25 pm

Running time: 1:25 pm to 4:35 pm

Operated at runaway rate of 54 cycles per minute.

10,000 cycles; time and maintenance check. Time, 1/235 sec.

Total Cycles: 60,000

Nov. 7, 1957 - Thursday

Test continued at 8:35 am

Running time: 8:35 am to 10:00 am

Operated at runaway rate of 54 cycles per minute.

4,500 cycles. Stopped test at 10:00 am due to motor dropping in speed to 36 cycles per minute and overheating. Motor had not been overhauled at 50,000 cycles per maintenance check list in order to verify this requirement. Motor M & O overhaul was done at this time and worm gear changed to Position #3. Total cycles on worm gear Position #2, 64,500.

Total Cycles: 64,500

Nov. 8, 1957 - Friday

Test continued at 9:00 am

Running time: 9:00 am to 11:00 am

Operated at runaway rate of 46 cycles per minute and at completion of 10,000 cycle period, had slowed to 43 cycles per minute. Removed unit from test and subjected it to a photographic timing test, then a 10,000 cycle maintenance check. Minor worm gear adjustments were made to improve motor speed. Exposure speed, 1/240 sec.

5,500 cycles

Total Cycles: 70,000

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Nov. 8, 1957 - Friday

Test continued at 11:30 am

Running time: 11:30 am to 1:55 pm
and: 2:05 pm to 4:00 pm

Operated at runaway rate of 46 cycles per minute. Speed, 1/235 sec.

10,000 cycles — Total Cycles: 80,000

Nov. 8, 1957 - Friday

Test continued at 4:10 pm

Running time: 4:10 pm to 4:30 pm

Operated at runaway rate of 46 cycles per minute.

900 cycles. Test off for weekend. — Total Cycles: 80,900

Nov. 11, 1957 - Monday

Test continued at 2:45 pm

Running time: 2:45 pm to 4:30 pm

Operated at runaway rate of 45 cycles per minute.

4,900 cycles. End of day. — Total Cycles: 85,800

Nov. 12, 1957 - Tuesday

Test continued at 9:00 am

Running time: 9:00 am to 10:15 am

Operated at runaway rate of 46 cycles per minute; slowed to 45 cycles per minute.

4,200 cycles to 10,000 cycle check. Changed worm gear to position 3-1/2. Speed 1/230 sec. — Total Cycles: 90,000

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Nov. 12, 1957 - Tuesday

Test continued at 1:15 pm

Running time: 1:15 pm to 4:30 pm

Operated at runaway rate of 46 cycles per minute.

10,000 cycles. Test stopped for the night and 10,000 cycle check.

Total Cycles: 100,000

Nov. 13, 1957 - Wednesday

Unit given 10,000 cycle maintenance check and photographic timing test. Speed, 1/240 sec.

Test continued at 8:30 am

Running time: 8:30 am to 9:30 am

Operated at runaway rate of 51 cycles per minute. K-2 relay contacts began sticking, causing mis-latching at runaway operation. This condition was anticipated, so unit was changed from runaway to intervalometer operation, set to pulse 28 cycles per minute, and shutter continued to operate properly on intervalometer. Sticky relay was retained to determine margin of safety and ultimate life under normal conditons.

3,060 cycles

Total Cycles: 103,060

Nov. 13, 1957 - Wednesday

Test continued at 10:00 am, continuing shutter on intervalometer at 28 cycles per minute.

Running time: 10:00 am to 1:30 pm

6,940 cycles to 10,000 cycle check and 50,000 cycle M & O motor

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overhaul and worm gear adjustment. Speed, 1/235 sec.
Total Cycles: 110,000

Nov. 13, 1957 - Wednesday

Test continued at 3:30 pm after motor overhaul.

Running time: 3:30 pm to 4:30 pm

Shutter ran on intervalometer at 28 cycles per minute. Runaway rate, 50 cycles per minute.

1,680 cycles. Stopped test for the night. Total Cycles: 111,680

Nov. 14, 1957 - Thursday

Test continued at 7:50 am

Running time: 7:50 am to 12:50 pm

Shutter ran on intervalometer at 28 cycles per minute. Unit removed from test and subjected to a timing test and 10,000 cycle inspection. Runaway cycling rate, 50 cycles per minute. Speed, 1/245 sec.

8,400 cycles Total Cycles: 120,000

Nov. 14, 1957 - Thursday

Test continued at 2:00 pm

Running time: 2:00 pm to 5:00 pm

Shutter ran on intervalometer at 28 cycles per minute. Runaway cycling rate, 50 cycles per minute. Test off for the night.

5,060 cycles Total Cycles: 125,060

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Nov. 15, 1957 - Friday

Test continued at 8:00 am

Running time: 8:00 am to 10:55 am to 10,000 cycle check.

Shutter ran on intervalometer at 28 cycles per minute. Runaway rate, 50 cycles per minute. Speed, 1/240 sec.

4,860 cycles Total Cycles: 130,000

Nov. 15, 1957 - Friday

Test continued at 11:30 am

Running time: 11:30 am to 4:30 pm

Shutter ran on intervalometer at 28 cycles per minute. Runaway rate, 50 cycles per minute. Test off for weekend.

8,500 cycles Total Cycles: 138,500

Nov. 18, 1957 - Monday

Adjusted limit switches before resuming test.

Test continued at 8:45 am

Running time: 8:45 am to 9:45 am

Stopped test to make a 10,000 cycle check and photographic timing test. Speed, 1/240 sec. Runaway cycling rate, 50 cycles per minute.

1,500 cycles Total Cycles: 140,000

Nov. 19, 1957 - Tuesday

Conducted low temperature test in cold box.

At 8:00 am, placed unit in a cold chamber at +35°F and allowed to stabilize for one hour. Circulating fan in dry ice chamber turned on

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at 9:00 am and temperature dropped momentarily to -65°F. Shutter would not operate at this temperature. Turned off fan and temperature gradually returned to +35°F. Tested shutter during warm-up period and normal operation began at -20°F. Cold chamber stabilized at +35°F and operating test started at 9:15 am.

Running time: 9:15 am to 3:15 pm continuous.

Shutter operated on intervalometer at 28 cycles per minute, at +35°F. Runaway rate, 48 cycles per minute. Stopped test to make a 10,000 cycle maintenance check and photographic timing test. Speed, 1/240 sec. Test off overnight.

10,080 cycles Total Cycles: 150,080

Nov. 22, 1957 - Friday

Conducted altitude test in combination with low temperature. Packed bell jar with dry ice and applied vacuum to simulate 40,000 ft. altitude at +32°F. Test continued in low pressure and cold at 9:30 am.

Running time: 9:30 am to 3:30 pm continuous.

Shutter ran on intervalometer at 28 cycles per minute, simulated 40,000 ft. altitude and +32°F. Runaway rate, 48 cycles per minute. Test off at 3:30 pm and unit subjected to photographic test. Speed, 1/240 sec.

9,920 cycles Total Cycles: 160,000

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Nov. 25, 1957 - Monday

Rewind motor given 50,000 cycle overhaul and worm gear adjusted.

Test continued at 3:30 pm at ambient room temperature and pressure.

Running time: 3:30 pm to 4:30 pm

Shutter operated on intervalometer at 28 cycles per minute. Runaway rate, 46 cycles per minute. Test off for the night.

1,680 cycles — Total Cycles: 161,680

Nov. 26, 1957 - Tuesday

Test continued at 8:00 am

Running time: 8:00 am to 10:30 am

Shutter operated on intervalometer at 28 cycles per minute. Runaway rate, 45 cycles per minute. Room ambient. At 9:00 am, 165,860 cycles, motor slowed down, approaching 30 cycles per minute. Stopped test at 10:30 am as unit required motor and gear adjustment.

4,200 cycles — Total Cycles: 165,880

Nov. 26, 1957 - Tuesday

Test continued at 11:00 am at cycling rate of 45 cycles per minute. Running time: 11:00 am to 1:30 pm, 4,200 cycles to 10,000 cycle check. Shutter operated on intervalometer at 28 cycles per minute. Runaway rate at end of period, 35 cycles per minute. Unit removed from test and subjected to a 10,000 cycle photographic timing test and maintenance check. Speed, 1/230 sec. Test shows shutter bounce of 1 M/S duration and approximately 10% amplitude. Wear

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in ring gear teeth and bearing grooves permits excess backlash (1/4") in blade overlap. No eccentric adjustments left to compensate for wear. Worm gear worn beyond satisfactory service, no re-adjustment positions left.

Total Cycles: 170,000

Test discontinued and shutter assigned to Engineering for detailed wear analysis.

CONCLUSIONS:

1. Shutter #39 operated 170,000 cycles without malfunction.
2. The field instructions to inspect and adjust every 5,000 cycles has at least 100% safety factor.
3. The field instructions to replace the rewind motor at 50,000 cycles has a 30% safety factor.
4. The field instructions to rotate worm gear to new operating position every 20,000 cycles has safety factor of 20% [redacted] minimum.

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Enclosure (3)

TO: W. A. Stewart Date: 3 December 1957

FROM: Don Moors

SUBJECT: Progress Report on the 73-B Vibration Problem

A vibration study of Configuration 73-B has been undertaken to determine to what extent vibration was causing image degradation, to find the source of image degrading vibrations, and to investigate methods of isolation.

Instrumentation

Vibration measuring equipment has been purchased and used. This equipment consists of an piezo-electric type accelerometer and an amplifier with a double integrating network incorporated in it. The output of this equipment is displayed on an oscilloscope.

A multi-channel pickup and amplifier system is now being made up. This system will have the capability of in-flight recording using a Century Recorder.

Test Results

Preliminary tests showed a severe transient on the lens housing due to the shutter. Subsequently a shutter was shock mounted by relieving the shutter housing approximately 1/32 inch [redacted] and supporting the shutter on rubber pads. It was found that with proper installation of this mount, the displacement of the lens housing could be reduced to .0005 of an inch during the exposure. A subsequent flight (PTF 216) with the oblique drive locked in vertical position showed a definite improvement. To date, the same quality has not been obtained with the oblique drive operating, however, ground tests with the configuration in the airframe have shown that all transient vibrations excited by oblique positioning are damped out before the subsequent exposure in all modes of operation.

Measurements made on the mirror with all components operating including the shock mount shutter show movements ranging from .0003 to .0001 inches during the exposure. Measurements with the shutter disconnected indicate no more than .00015 inch of movement. No significant change was observed with the oblique drive disconnected. Displacement of the mirror appears to be slightly less at the top than at midpoint, though no conclusions can be made as to the amount of rotation until measurements can be made with the multichannel recording system.

Readings taken on the structure adjacent to the take-up motors indicate that rubber mounting of motors effectively isolates a 600 cps ripple that seems to be responsible for much of the audio noise though there is no

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indication that this component is present on the optical assembly. The accompanying table briefly summarizes the data to date.

Conclusions

1. The present method of shutter shock mounting is a definite improvement, however, it is probable that more improvement could be realized with a mounting system with greater side to side compliance.

2. Rubber mounting the take-up motor will probably not make a significant improvement in image quality at this time. Rubber mounting will reduce audio noise.

3. The shutter is the major displacer of the mirror.

4. Transient vibrations excited by oblique positioning are damped out in sufficient time.

Recommendations

1. More work on the shutter mounting:

    a. Modify one lens housing to accommodate a more compliant mounting system.
    b. Ground test and flight test the modified shutter mounting.
    c. Make tests to determine how the shutter transient is transmitted to the mirror and evaluate methods of isolation.

2. Make in-flight recordings to determine the frequency and amplitude of A/C vibration.

3. Determine the resonate frequencies and modes of vibration of all optical components.

4. Continue to investigate other causes of image degradation such as A/C motion.

Don Moors

DM/pe

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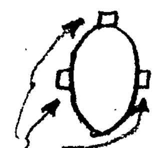
PREPARED BY DM	HYCON MFG. COMPANY PASADENA CALIFORNIA	PAGE
CHECKED BY	VIBRATION DATA - CONFIG. 73-B (REVISED 12-2-57)	JOB
DATE 12-2-57		REPORT

PICKUP LOCATION & FORCING FUNCTIONS	DISPLACEMENT DURING EXPOSURE (INCHES)			REMARKS
PLATEN	VERTICAL	SIDE TO SIDE	FORE & AFT	
1. UNMODIFIED SHUTTER	.0002	.0002	.0003	
2. RUBBER MOUNTED SHUTTER	.0001	.0001	—	
3. ALL COMPONENTS EXCEPT SHUTTER	<.0001	<.0001	—	
LENS HOUSING	VERTICAL	SIDE TO SIDE	FORE & AFT	
1. UNMODIFIED SHUTTER	.002	.003	.003	
2. RUBBER MOUNTED SHUTTER	.0002	.0007	.0003	
3. ALL COMPONENTS EXCEPT SHUTTER	.0001	.0001	.0001	
MIRROR	LEFT	TOP	RIGHT	
1. UNMODIFIED SHUTTER	.0006	—	—	
2 RUBBER MOUNTED SHUTTER ONLY	.0003	.00015	.0003	ACCELEROMETER LOCATIONS (NORMAL TO SURFACE)
3. ALL COMPONENT EXCEPT SHUTTER	.0001	—	.00015	

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Enclosure (4)

TO: P. Rosenblum DATE: 3 December 1957

FROM: S. W. Rawson

SUBJECT: Radio Interference Tests on HR-73C Configuration

1. Introduction. Modifications to eliminate radio interference from the 73C Camera have been installed in Unit #2 at the Test Site. Two flights have been made since the installation. Prior to each flight the pilot was briefed to test all previously affected equipment. The results indicate that radio interference was not detectable.

2. Purpose of Tests. Previous operation of the 73C Camera in flight interferred with the aircraft radio equipment.

3. Interference Sources. All suspected sources of radio interference were tested by the radio noise facilities at Cornell-Dubilier Electric Corp., Venice, California. The frequency range was 150 KC to 1000 megacycles. The following units were found to be prime sources:

1. Aperture Motor
2. Film Drive Motor
3. Film Take-Up Motor
4. Oblique Drive Motor
5. Tension Regulator Motors
6. Gyro Sensor Assembly
7. Programmer
8. Switches

4. Modifications Required. The following modifications were made on the above equipment.

1. Motors. Filters, shielded housings and shielded wire were installed. Bonding was improved.

2. Programmer. Feed-through capacitors were installed installed in noisy lines. A shielded compartment for the filters and shielded wire was used.

3. Gyro Sensor Assembly. R-C filters were installed across the heater relay contacts.

4. Switches. R-C filters were installed.

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5. <u>Test Results.</u> The following tests have been performed:

a. <u>Laboratory Tests.</u> After modification the motors were tested at Cornell-Dubilier over the frequency range of 150 KC to 1000 megacycles. The radio interference present was negligible.

b. <u>Ground Systems Tests.</u> After the modified units were installed in Unit #2 at the Test Site, the Configuration was installed in the article. The article was towed to a remote section of the flight line. The Configuration was operated for one-half hour while Mr. Joe Falcon, aircraft radioman, operated the radio equipment. All radio channels and frequencies were checked. Mr. Falcon reported the interference was negligible.

c. <u>Flight Tests.</u> PTF 215 and PTF 218 were used as tests. The pilot was briefed to test all radio equipment over all frequency ranges. Glenn Fulkerson and the pilot have notified us that radio interference during flight operation of the Configuration was undetectable.

[redacted] 25X1

SWR/bjs

Approved [redacted]

25X1

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Enclosure (5)

TO: [redacted] 25X1

FROM:

SUBJECT: Interim Report, Cold Temperature Tests, Configuration 73-C Optical System.

I SUMMARY

The purpose of the temperature tests was threefold. First, it was desired to obtain measurements of the magnitude and direction of focus change for operating temperatures below 75° F. The second objective was to duplicate in-flight temperature conditions, and measure focus shift under such conditions, and, finally, to determine the effectiveness of the lens barrel, invar rod, and panel heaters.

In the temperature range of 53° F to 85° F, average focus shift was found to be .013 inches per degree F (Curves #1 and #2). The direction was such that a decrease in temperature resulted in a decrease in back focal length, and vice-versa.

Because of the turbulence existing when the configuration was being cooled, it was difficult to accurately read focus shift during the test that duplicated in-flight temperature conditions. However, the results are summarized in Curve #3 where the incremental focus shift was found to be .007 inches per degree F.

During the test on heater effectiveness, the invar rod heaters created so much turbulence (caused by heat radiation) that the test results were inconclusive. Before any reasonably accurate determination of heater effectiveness can be made, it will be necessary to shield the invar rod heaters. Such shielding should be relatively simple, and a retest is contemplated shortly.

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II TEST EQUIPMENT

A. Enclosure. For the cold temperature tests the configuration was enclosed in a block house consisting of four inch thick "styrafoam" blocks, and measuring approximately 6' x 6' x 7'.

B. Coolant. From 125 to 175 pounds of dry ice were used for each of the cold temperature runs. The time required to bring the air inside the blockhouse down to 43° F was four hours; and to 30° F, the time was six hours. While going down to temperature, air inside the enclosure was circulated by means of a 28 volt aircraft cockpit fan.

C. Temperature Measurement

1. Two mercury thermometers were used for measuring air temperature inside the enclosure.

2. A Leeds and Northrup type - thermocouple bridge was used to monitor temperatures at the following five points: surface of projection lens barrel at thermostat; lower projection lens barrel at elbow junction; invar rods at thermostat; light tight compartment at thermostat; outside surface of primary mirror casting.

D. Focus Measuring. A laboratory devised autocollimator was used to measure focus shift. The autocollimator consisted of a ten power magnifier, a light source, and a reticule. Collimator light was projected through the optical system and reflected back by means of a reflecting flat, borrowed from the 300" collimator. The return image of the small auto collimator reticule was viewed at the focal plane of the configuration optical system. The magnifier was movable with respect to its mounting base, and focus shift for various temperatures was taken as actual measured changes in focus from the reference focus position at room temperature.

The field angle of the magnifier is quite small and difficulty was experienced in keeping the return image in the collimator field. As the temperature changed, the image tended to drift out of the collimator field and had to be brought back by reaching into the blackhouse and adjusting the reflecting flat.

III TEST PROCEDURE

The first test consisted of a check of the lens barrel only. Before any focus

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checks were made, the entire configuration was cooled to a temperature of approximately 30° F. Unfortunately, during the process of removing the dry ice and adjusting the reflecting flat prior to actual focus measurement, sufficient warm, moist air got into the test chamber to deposit a light coat of frost on the reflecting mirror, the rocking mirror, and the primary mirror. In the course of waiting for the frost coat and the subsequent water drops to evaporate from the mirrors, the temperature in the enclosure increased to about 50° F. So, the first test run started at a higher temperature than originally planned. Focus readings were made as the configuration warmed up, without the aid of heaters, to approximately 63° F (See Curve #1). At that point, the collimator image drifted out of the field, and it became necessary to readjust the reflecting flat to bring the image back into the collimator field. In so doing, a different portion of the reticule pattern came into best imagery, and it was felt there was not accurate correlation between the autocollimator readings before adjustment with those after adjustment. Accordingly, the results from 63° F to 84° F are presented on another curve (#2).

At the start of the second set of readings the lens barrel heaters were turned on for three to five minutes and then turned off. Before surface temperature and focus readings were made, the lens barrel was allowed to stabilize for approximately ten minutes. (In general, temperature and focus readings were made every 15 minutes). At 76° F, the lens barrel heaters were turned on and left on. Focus and temperature readings were taken until both stabilized. The results are shown in curve #2.

The final focus shift-temperature test was the one in which the in-flight temperature conditions were duplicated. Starting at ambient temperature, a reference focus reading was taken, and the configuration started on the cooling cycle. Shortly after the cooling cycle started, another reference reading was taken, and the lens barrel heaters turned on. The configuration was cooled down to 40° during which time the lens barrel surface temperature remained constant within one and one-half degrees. As the temperature dropped, focus readings were difficult to make because of the turbulence created by circulation of the cold air and CO_2.

The results of this test are shown on Curve #3. At the end of the cooling cycle, the dry ice was removed. With the lens barrel heaters left on, the invar rod heaters were also turned on, and an attempt was made to record focus shifts as the invar rods warmed up. However, when the invar rod heaters were turned on in a cold configuration, radiation from the heaters created so much turbulence that it was virtually impossible to arrive at an in focus setting with the autocollimator.

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DISCUSSION

Curve #1 and Curve #2 are curves of lens barrel surface temperature vs focus shift for two different temperature ranges. It is interesting to note that on Curve #1 the overall configuration temperature rose 7° F while the lens barrel surface temperature rose 10° F., and the incremental focus shift, was $\Delta f = .011''/^\circ F$. (Focus shift is indicated as a positive number, that is BFL increased with increasing temperature.) In curve #2, the configuration temperature remained constant while the lens barrel surface temperature was caused to rise 17° F. In this case, the incremental focus shift was $\Delta f = .014''/^\circ F$. Curve #2, then, is probably a fairly accurate representation of the effect of temperature change on the optical elements in the projection lens barrel only. Curve #1 in which the configuration temperature varied slightly, still yields results which are reasonably consistent with those of Curve #2.

The test summarized in Curve #3, gives an indication of the effect on focus caused by a temperature change in the configuration. The lens barrel surface temperature was held constant by means of the barrel heaters. Because of the turbulence present, during cooling, the results of this test are not very accurate, but do indicate that the direction of focus shift is in the same direction as curves #1 and #2. Although, in this test, the lens barrel, barrel surface temperature was kept constant, the lens barrel heaters were on most of the time. This would indicate that there is probably considerable heat loss in the lens barrel, and that the lens barrel heaters may not be adequate, and that the lens barrel is actually contributing to some of the focus shift indicated in Curve #3. This is another feature that will be checked during the next series of temperature tests.

When the invar rod heaters were turned on, turbulence, as previously noted, was sufficient to make focus reading impossible. Under operating conditions the offending portion of the invar rod heater are right above the windows, and, therefore, are in the coldest portion of the equipment bay. Until some form of shielding is devised, it is probably inadvisable to use the invar rod heaters in flight, the resulting turbulence would probably create significant distortion.

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JHS/mj

cc: [redacted] 25X1

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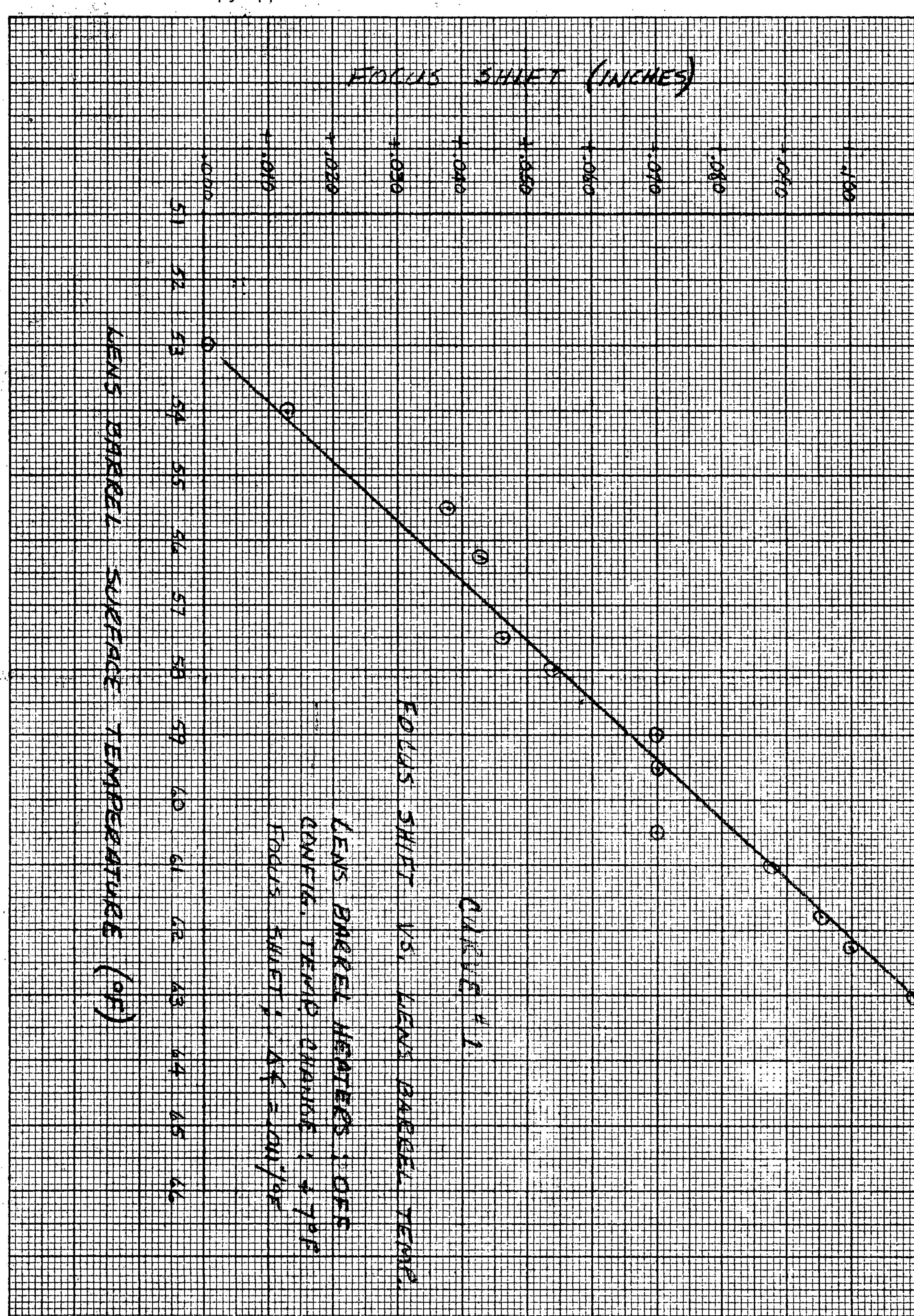

CURVE NO. 1

K+E 10 X 10 TO THE 1/2 INCH 359-11 KEUFFEL & ESSER CO. MADE IN U.S.A.

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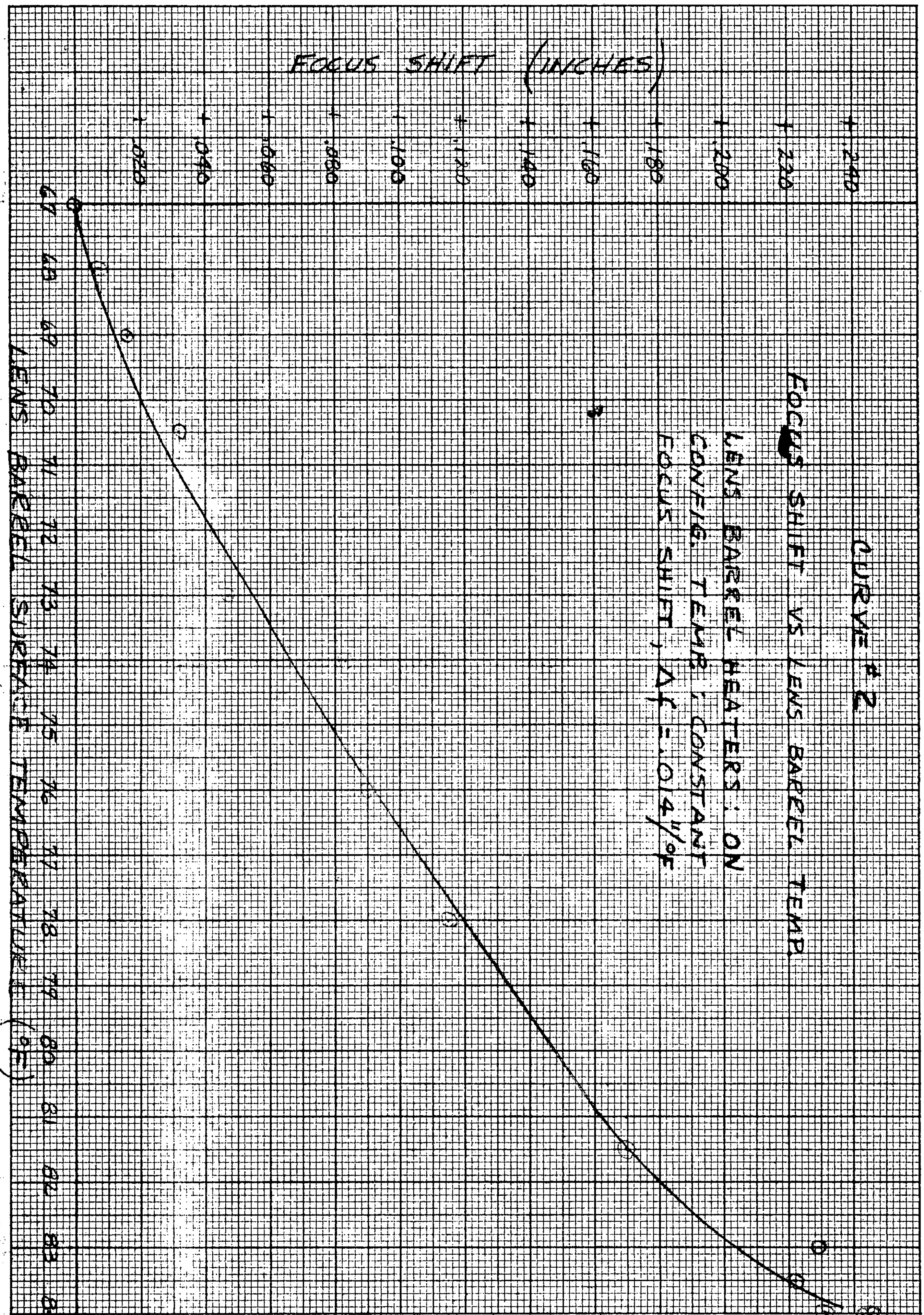

CURVE NO 2

K+E 10 X 10 TO THE ½ INCH 359-11
KEUFFEL & ESSER CO. MADE IN U.S.A.

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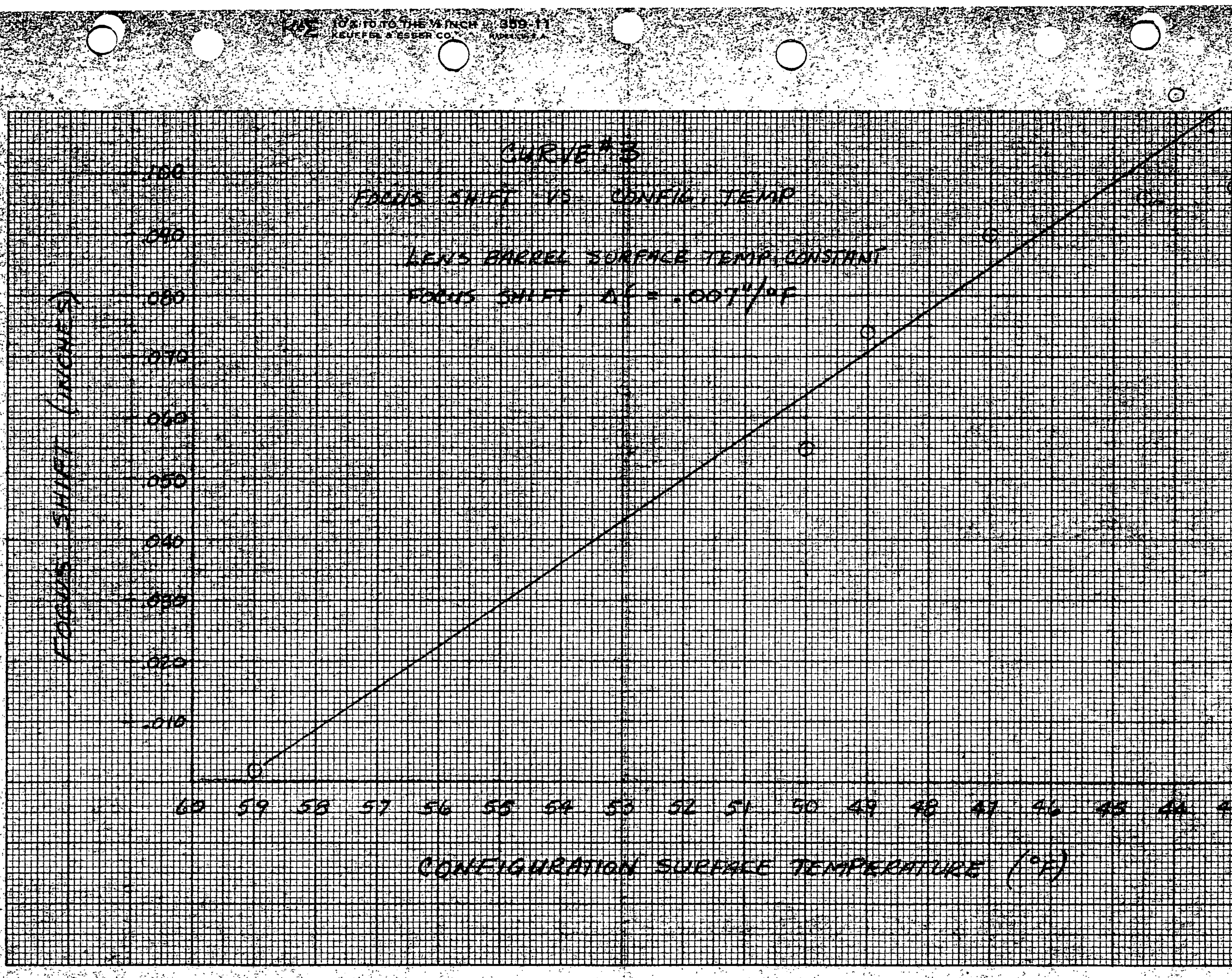

CURVE NO. 3

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Enc (6)

FLIGHT TEST SCHEDULE

23 Dec. 1957

Period		B			C	TRACKER			THREE V-RED DOT
Week	Date	Service 6000	Quality 4000	Red Dot	#2, 3, 4, 5, 6	Red Dot 3 T Hatch	Service 16	Processing Studies	14 Tests (Every clear day)
1	6-10 Jan.	B #7				Test #1		1 roll	
2	13-17 Jan.	B #2 B				#2, #3		2 rolls	
3	20-24 Jan.	B #8 C	B #2 B			#4, #5		3 rolls	Test #1
4	27-31 Jan.	B #9 B	B #8 C					3 rolls	Test #2, #3
5	3 - 7 Feb.	B #5 C	B #9 B				4 Trackers	3 rolls	Test #4, #5, #6
6	10-14 Feb.	B #6 B	B #5 C		C #4		4 Trackers	3 rolls	Test #7, #8, #9
7	17-21 Feb.	B #10 C	B #6 B		C #4		4 Trackers		Test #10, #11, #12
8	24-28 Feb.	B #14 Fac	B #10 C		C #4		4 Trackers		Test #13, #14
9	3 - 7 Mar.	B #15 "	B #14	B #7	C #4				
10	10-14 Mar.	B #17 "	B #15	B #7	C #4				
11	17-21 Mar.	B #16 "	B #17	B #7	C #4				
12	24-28 Mar.	B #12	B #16						
13	31 Mar. 4 Apr.	B #3	B #12		C #3				
14	7 - 11 Apr.	B #1	B #3		C #3				
15	14-18 Apr.	B #7	B ~~#1~~		C #3				
16	21-25 Apr.		B #7		C #3				

Personnel

"B" Configuration

"C" Config.

H/C-Drift Sight Tracker

Articles

343 for 25X1 B

349 Tracker

356 Red Dot B

347

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25X1

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PRELIMINARY ENGINEERING REPORT ON RESOLVING POWER OF SOME AERIAL FILMS

1. Purpose

To test various films for resolving power using standard processing.

2. Approach

Use a glass reticle as a target, place the film emulsion to emulsion of the reticle, expose to a "point" light source and process.

3. Materials and Equipment

3 Films were tested

- A. Aerographic Supper XX
- B. 0-3 Thin Base (Regular)
- C. 0-8 Thin Base (Fine Grain)

All were processed 5 minutes. in D-19 at 68° F. The equipment was set up in the lab as shown in diagram 1. The shroud was used to cut down on the stray light reflecting from the walls, etc. Neutral density filters were required over the shutter aperture to bring the exposure time within the range of the shutter. The reticle plate was a Buckbee-Mears high contrast target on a glass plate. One test was made with a contact printer for a light source and the results are described in paragraph #6.

4. Discussion

Several exposures were made on each strip of film and the exposure that gave the best resolution was used as the basis for the discussion of the report. The negatives were examined with a 36 power microscope.

Film	Pattern	Lines/mm
Aero XX	6.1	64
0-3	6.3	81
0-8	6.6	114

It should be noted that 6.6 is the last pattern on the reticle. The 0-8 emulsion probably can resolve move than the indicated 114 L/mm.

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The gammas normally obtained with this processing are:

Film	Gamma
Aero XX	1.2
0-3	1.4
0-8	2.2

5. Lens and film combinations

There are two formulas that are suggested to determine the resolving power of any lens - film combination. These are only to be used for "rule of thumb" calculations [1]

$$(1) \quad \frac{1}{R_{f+1}} = \frac{1}{R_f} + \frac{1}{R_1}$$

or

$$(2) \quad \frac{1}{R^2_{f+1}} = \frac{1}{R^2_f} + \frac{1}{R_1^2}$$

R_{f+1} = Resolving power of combination of lens and film

R_f = Resolving Power of the Film

R_1 = Resolving Power of the Lens

for these calculations assume that the lenses have a resolving power of 60 L/mm.

Film	Formula (1)	Formula (2)
Aero XX	31 L/mm	44 L/mm
0-3	35 L/mm	48 L/mm
0-8	39 L/mm	53 L/mm

6. Miscellaneous

One test was made with the 0-8 emulsion using a contact printer for a light source. (See Diagram). There is a very significant decrease in the resolving power compared with the "point" light source test.

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References.

[1] Method for Determining the Resolving Power of Photographic Lenses
National Bureau of Standards Circular 533 (1953)

25X1

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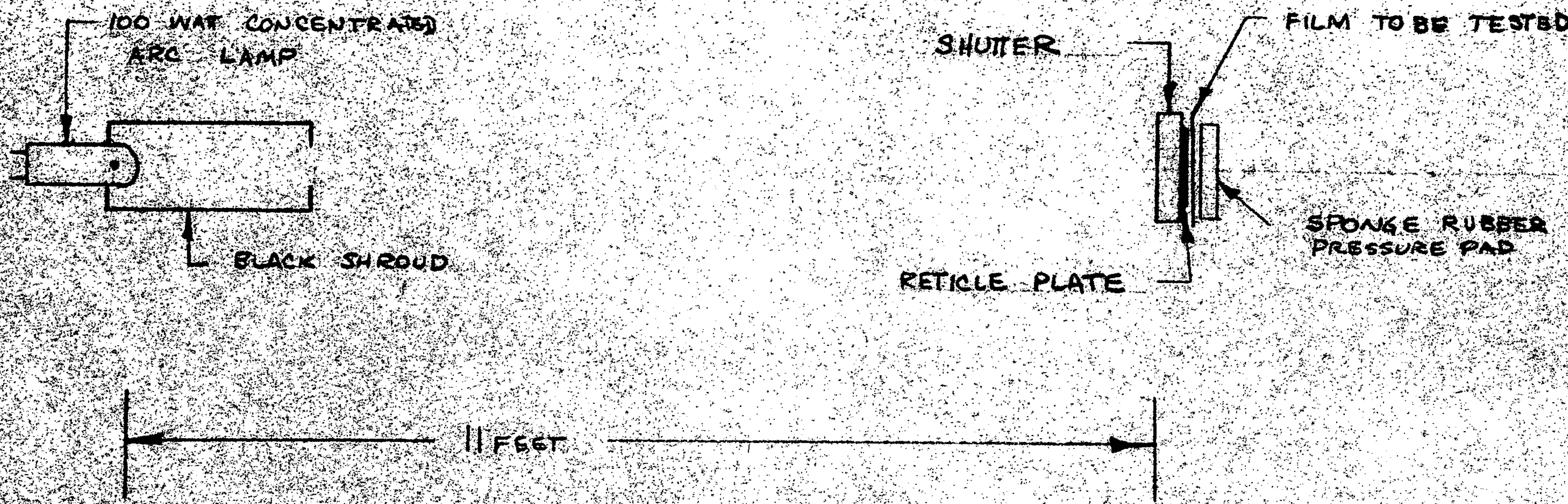

DIAGRAM 1

EQUIPMENT SETUP

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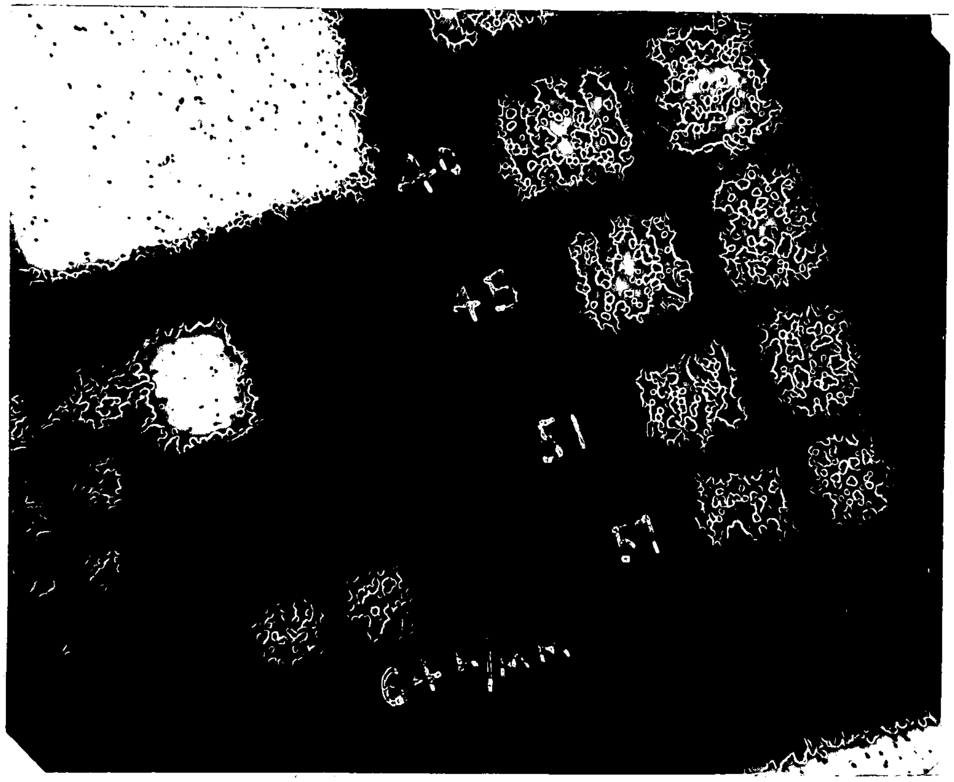
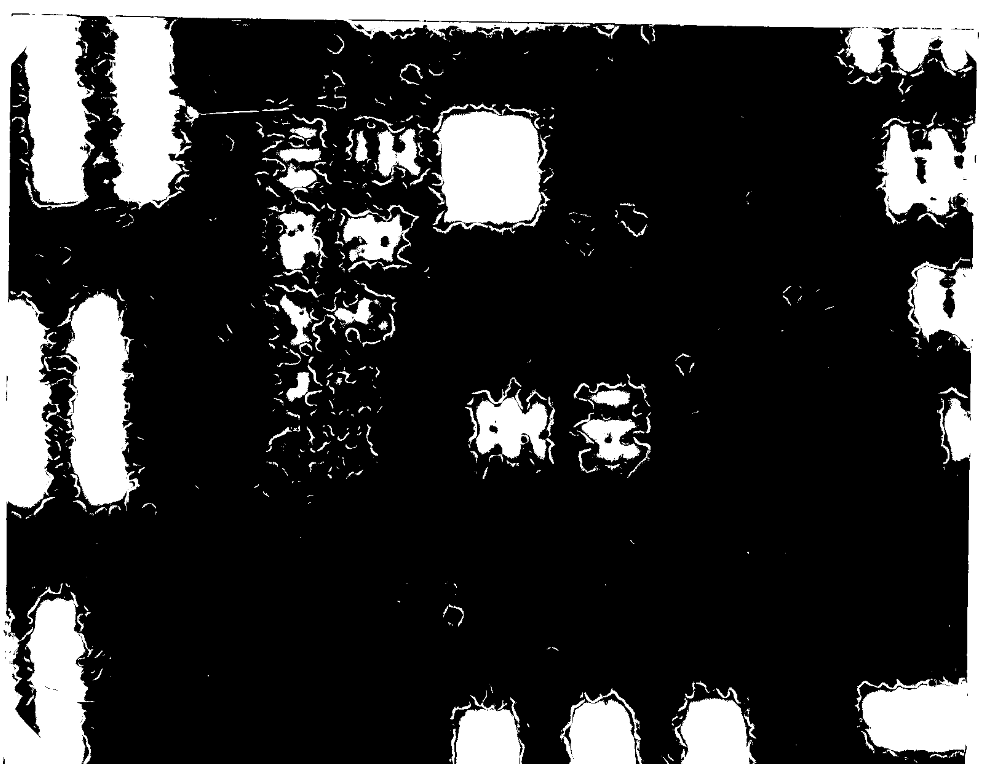


Diag. #2 Aero XX Emulsion. (Point Source) (250 X Approx.)



Diag. #3 0-3 Emulsion (Point Source) (250 X Approx.)

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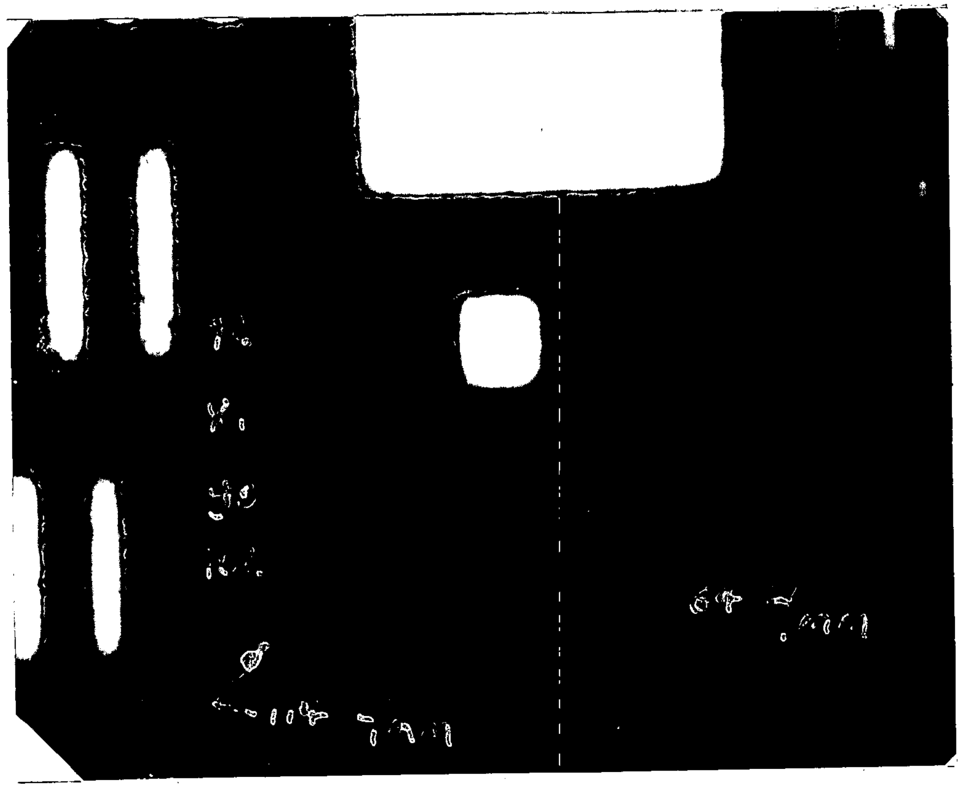
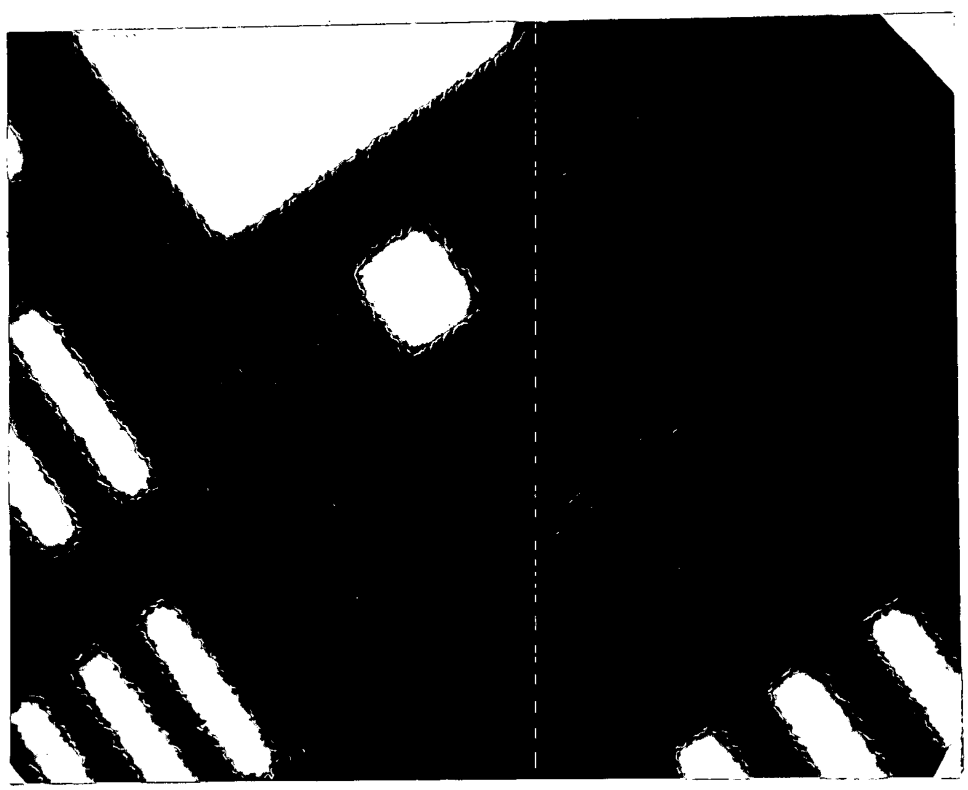


Diag. #4 0-8 Emulsion (Point Source) (250 X Approx.)



Diag. #5 0-8 Emulsion (Contact Printer) (250 X Approx.)

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Enclosure (9)
Page 1
30 December 1957

25X1

To: [redacted]

From:

Subject: Location of Configurations

Our latest information indicates the physical locations of the configurations are as follows:

1. A-1 CONFIGURATIONS

Serial No. Tri-Mount	Rocker	Location	Customer	Remarks
1	2	Salvage	A	
2	6	Del Rio (FOG)	B	Complete w/24" HR-731
3	3	Det C	A	w/o HR-731
4	4	Det C	A	w/o HR-731
5	5	Det B	A	w/o HR-731
6	1	Del Rio	B	Complete
7	7	Del Rio	B	Complete
8	8	M & O	B	w/o HR-731 - Received from Customer A for overhaul prior to shipment to Customer B. Cartographic characteristics of optics being checked.
9	9	Det B	A	w/o HR-731

2. A-2 CONFIGURATIONS

Serial No.	Location	Customer	Remarks
1	Det C	A	
2	Salvage	A	
3	Det B	A	
4	Det B	A	
5	Det B	A	
6	M & O	B	Received from Customer A for M & O prior to shipment to Customer B

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2. A-2 CONFIGURATIONS (Continued)

Serial No.	Location	Customer	Remarks
7	Salvage	A	
8	M & O	A	To be used for Series III Red Dot
9	Det C	A	
10	Del Rio	B	
11	Del Rio	B	
12	M & O	B	Awaiting airlift to Del R
13	M & O	B	Awaiting airlift to Del R
14	Del Rio	B	

3. B CONFIGURATIONS

Serial No.	Location	Customer	Remarks
1	M & O	A	
2	M & O	A	
3	M & O	A	
4	Salvage	A	
5	M & O	A	
6	M & O	A	
7	EAFB	A	Quality Tests
8	M & O	A	
9	M & O	A	
10	M & O	A	
11	Del Rio	B	For Training Use
12	M & O	A	
13	M & O	B	Awaiting airlift to Del Ri
14	M & O	B	
15	M & O	B	
16	EAFB	B	Quality Tests
17	M & O	B	

4. C CONFIGURATIONS

Camera No.	Lens No.	Location	Customer	Remarks
1		Plant	A	To be updated
2	1	Plant	A	Undergoing temperature and vibration tests.

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4. C CONFIGURATIONS (continued)

Camera No.	Lens No.	Location	Customer	Remarks
3		EAFB	B	Awaiting glass
4	2	Plant	A	*
5		Plant	B	Awaiting glass
6		Plant	B	Awaiting glass

*Trial installation of glass completed. Lens barrel being reworked at P & E.

5. SUMMARY

Physical Location	Config A-1		Config A-2		Config B		Config C		Track
	Cust A	Cust B	Cust A	Cust B	Cust A	Cust B	Cust A	Cust B	Cust
M & O		1	1	3	9	4	3	2	(PE)
EAFB		0	0	0	1	1	–	1	
Subtotal		1	1	3	10	5	3	3	
Depot A	0		0						
Det B	2		3						
Det C	2		2						
Subtotal	4		5						
Depot B		0		0		0			
Del Rio		3		3		1			
Subtotal		3		3		1			
TOTAL	4	4	6	6	10	6	3	3	
Salvage		1		2		1		0	
Total Serial Nos.		9		14		17		6	

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